

# Design and production of a paper printed and a digital-interactive accessibility map of the Aristotle University of Thessaloniki campus, Greece, for People with Disabilities

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**Abstract.** University community, like the rest of the society, includes people who have different mobility skills or different ability of perception. Basic right of all members of this community is the freedom of movement and access to all public places, but this is not easily accomplished, since there are often permanent or temporary obstacles in many places, interrupting the main route people with disabilities may follow, so that it is not possible for them to move around completely freely without obstructions.

The aim of this paper is the construction of an accessibility map in printed and digital-interactive form, based on data collected by fieldwork taken place in the Aristotle University of Thessaloniki, Greece, concerning particular spots in the open space of the University Campus, where people with disabilities will encounter difficulties to move freely or to have access to the buildings. This map helps these people to find the best way to their destinations but also, emphasizes that measures should be taken by the responsible services, in order to make the University campus accessible to all people.

**Keywords:** people with disabilities, digital interactive maps, map design, map production, mapping accessibility problems, maps for people with disabilities

## 1. Introduction

The main idea of this work is surveying and depiction of the situation concerning the accessibility of all institutions in the campus of Aristotle University of Thessaloniki by people with disabilities and the aim was triple: to make a map in both printed and interactive form describing the problems and proposing comfortable routes, secondly, to force authorities face their responsibilities and reorganize space according to the needs of students and university staff and last, to give an example and why not to apply the whole procedure to other university campuses in Greece. Sometimes, university establishments, especially in small cities, were not designed to be educational institutions and they don't fulfill at all the relative standards.

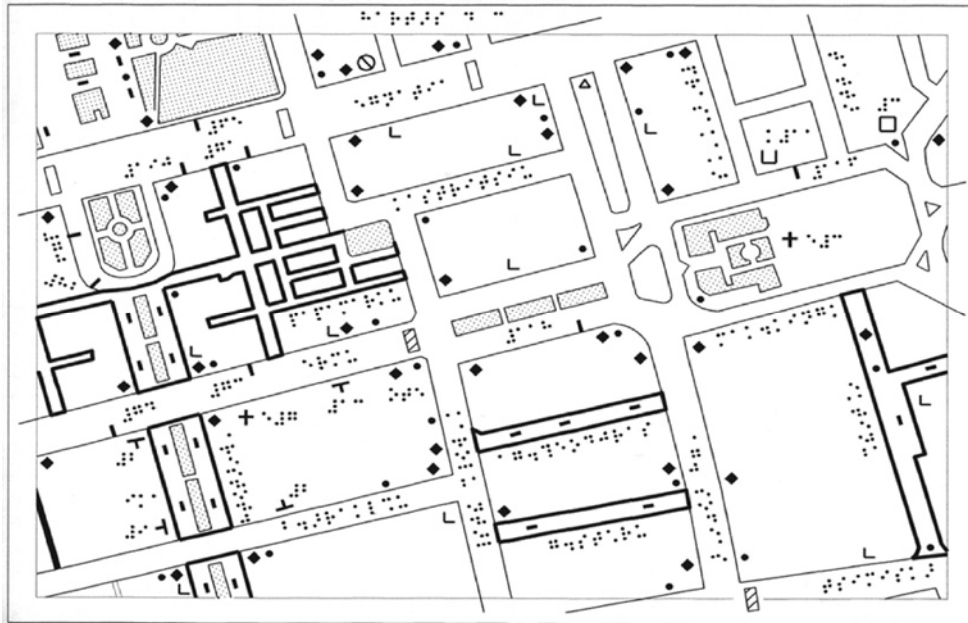
The concept of accessibility is a synonym of free mobility for People with Disabilities (PWD), a sensitive group of people, demanding specific requirements on their mobility. It is referred to the capability of access in all areas, which is related to the ability of autonomous physical attendance, movement and subsistence, as well as to the meaning of perception, which refers to the way that man perceives, understands the environment and is taught by it (Naniopoulos A., 2003). In a structured environment, all the necessary changes are made in order to eliminate the obstacles or to make them more easily accessible, so as to ensure accessibility to everyone. Responsible services and engineers have to design buildings and the public space in such a way as to allow independent living and mobility and thus protect the dignity of people with disabilities and challenged people. For this reason, the State has enacted legislation which dictates ways of design and construction of public space, in order to provide equal moving opportunities to everyone.

The mobility within the University campus and educational areas plays a key role, in order to ensure the participation of People with Disabilities in all educational activities. By preventing this, a limiting factor on the right to education of these people appears. According to the relevant law, the construction and modulation of public areas should fulfill the requirements which allow these people to have access to any public place. However, there are often permanent or temporary obstacles interrupting their route, or there are access points not easily approachable so that it is not possible for them to move around completely freely without obstructions.

For this reason, the registration of the obstacles and the difficulties in accessing a place, encountered by disabled people in their everyday life and their depiction on a map is very important and can be very helpful not only for these people themselves in finding the proper way to move in the University Campus, but for the responsible public services in order to take

measures and to improve this situation in a way that all people can move without problem.

It is worth to mention that 12 years ago, the Tactile Atlas of the City of Thessaloniki (including University campus) for visually impaired people was released at the Department of Cadastre, Photogrammetry and Cartography, School of Rural and Surveying Engineering of Aristotle University of Thessaloniki (DCPC-RSE, AUTH) with totally digital procedures (*Figure 1*).



**Figure 1.** Tactile Atlas of Thessaloniki. (Source: DCPC-RSE, AUTH)

## 2. Concepts and definitions

### 2.1. Categories of people with disabilities

Before start constructing a map depicting all the obstacles in the University Campus, it is important to define the different categories of people with disabilities. According to the Greek Ministry of Environment, Energy and Climate Change, disabled people are divided into two main categories, the people with disabilities and the special people.

#### *People with Disabilities*

The term “people with disabilities” is referred to individuals with serious defects or impairments due to injuries, including breakdowns of the senses

or cognitive or mental impairments that restrict or preclude enforcement activity or operation, which is considered normal for a human being. People with disabilities are about 10% of the total population of the country.

### *Special People*

Special People, except for People with Disabilities, are infants and young children, pregnant women, elders, escorts of disabled people and infants, people with abnormal physical dimensions, the object carriers, migrants, refugees, people who use or lead any trolley, who have temporary disability due to injury, taking medication or drugs etc. The special needs individuals, according to the statistical data of the Greek Ministry for the Environment, Energy and Climate Change, is nearly 50% of the total population of the country.

Considering University as a representative sample of society, it is easy to realize that in big Universities there is always a number of people with disabilities who move, study and pass all day in the campus.

## **2.2. People with disabilities in Greek Universities**

In accordance with the provisions of article 35 of national Law No. 3810/2009 for the Greek Universities it is applied that: "Access to higher education can have secondary school graduates who fall under the category of "sufferers of serious diseases" at a rate of 5% in excess of the number of students enrolling",. Additionally, the Law 1329/1983 introduces some special conditions and reforms with a view to introducing people with disabilities in higher education institutions.

In all 47 university campuses of Greece (*Figure 2*) and despite these reforms, students with disabilities are still quite a few, most of the times less than ten in an educational institution. Statistics show that the percentage of people with disabilities that are in the same age as students is about 3%. Assuming there is an equal distribution of students in each educational institution, around 590 disabled students are calculated in each educational unit. Comparatively, it is easy to understand the difference between students who supposedly should exist and those that do exist. One of the major reasons for this situation is considered to be the non-accessible premises of the campuses (Koutroulis 2005).

Therefore, it is obvious that University should have those facilities which will make it accessible to the 100% of its community. In other words, it should be designed and constructed according to the philosophy known as "design for all or catholic design" of 1998, a plan decided by the Ministry for

- removes the altitudinal ground differences or makes it easier to overcome the inevitable ones,
- provides comfortable and secure areas for the staying and service of people with disabilities, such as toilets,
- highlights the obstacles and dangerous spots,
- simplifies the equipment, making it accessible to everyone,
- adds value in the environment that is already built.

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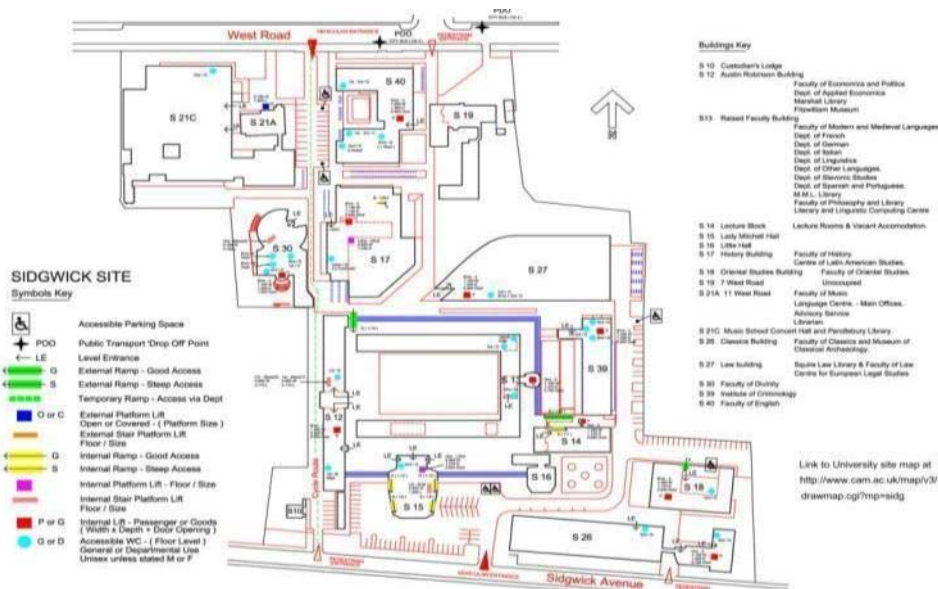


### Searching for University campus maps created for people with disabilities

that there are many universities around the world which have published detailed maps helping people with permanent or temporary disabilities to move and work without problems in the campus. Internet research at foreign educational institutions sites, showed the existence of uploaded maps assisting the free movement of people with disabilities in outdoor spaces. Some of them are giving details about their movement inside buildings.

In many countries, as for example in the United States of America and Great Britain, there is a particular concern in this area. Maps that indicate parking spaces at the University especially for people with disabilities or maps that locate the points on which provided access is easy for individuals with mobility impairments are some examples that prove the interest shown.

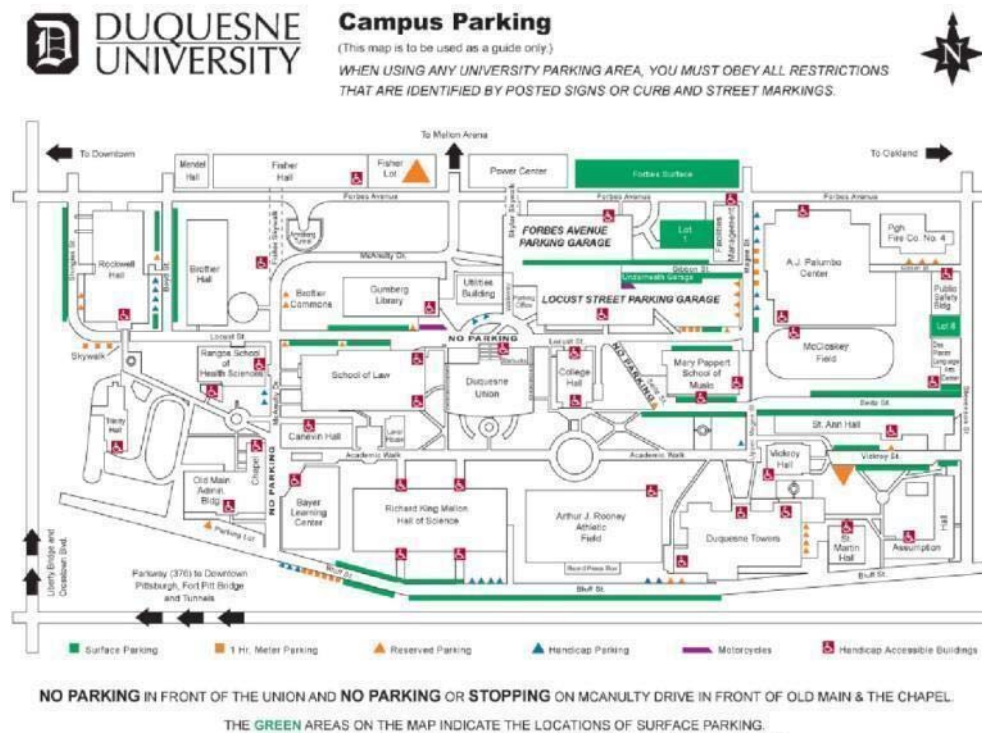
A representative sample of those maps is presented below. In *Figure 3*, a map constructed by the University of Cambridge shows all the access areas in the University, giving also emphasis to the ramps defining with symbols if the access is “good” or “steep”. As a result, the person with mobility impairments knows in advance the difficulty level to be met on his/her way. The rest of the maps (*Figure 4, 5*) are not that detailed as the one from the University of Cambridge; however, information about the accessibility of the University buildings by individuals with mobility impairments, special parking spaces and more information are provided.



**Figure 3.** Access map of University of Cambridge (Sidgwick site). (Source: <http://www.admin.cam.ac.uk/univ/disability/guide/maps/>)



**Figure 4.** Map of University of Edinburgh depicting the northern part of the central area of University. (Source: <http://www.ed.ac.uk/maps/access>)

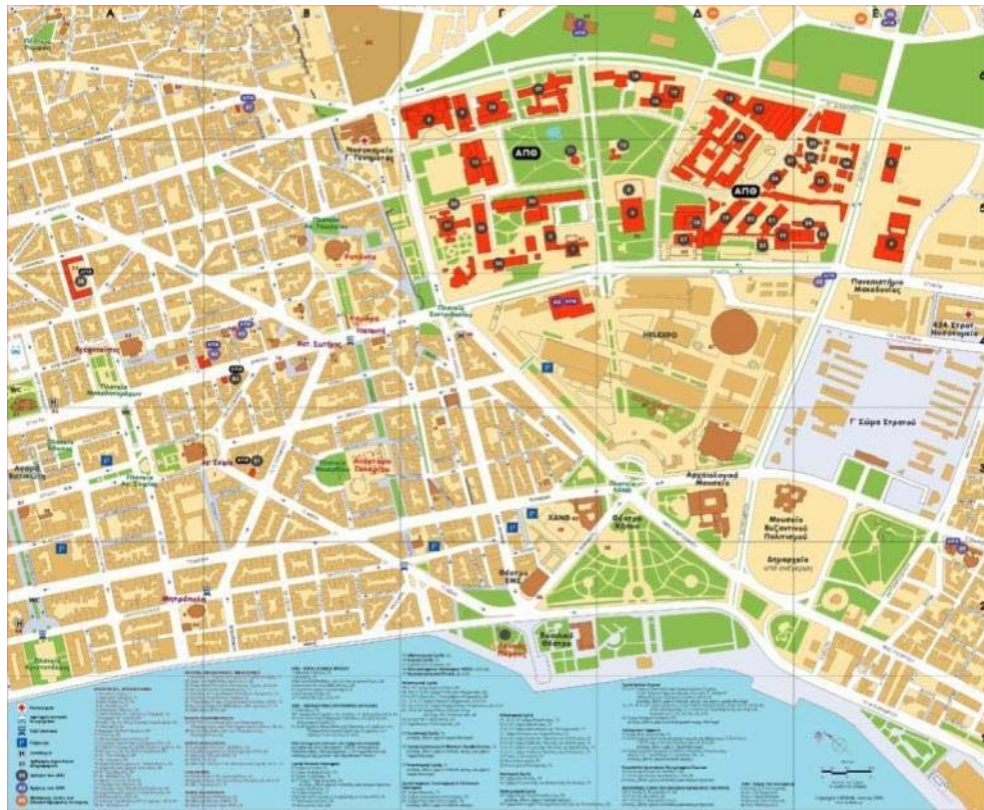


**Figure 5.** Access map of Duquesne University, Pittsburgh, Pennsylvania. (Source: <http://www.duq.edu/Images/special-students/>)



#### 4. Designing a map for the Aristotle University of Thessaloniki Campus, Greece

Thessaloniki, a city by the sea, hosts Aristotle University of Thessaloniki, the largest university in Greece. The main campus is located in the centre of the city (*Figure 6*) and covers an area of about 33.4 hectares. It comprises 7 faculties which consist of 33 schools, 5 faculties which consist of one school each, as well as 4 independent schools. About 81,500 students study at the Aristotle University (72,140 in undergraduate programs and 8,360 in post-graduate programs).



**Figure 6.** Map of Aristotle University of Thessaloniki. (Source: DCPC-RSE, AUTH)

Years ago, a map describing accessibility difficulties for people with disabilities for the Thessaloniki city center was made (*Figure 7*). During this project, we realized that there was inadequate care to the direction of helping special people to move around the city, in conjunction with bad attitude of people which in many cases destroys the elementary infrastructure and measures taken.





**Figure 7.** Access Map for People with Disabilities in the center of Thessaloniki.  
(Source: DCPC-RSE, AUTH)

The same problem exists in the University campus both in open air and inside the buildings. It is obvious that for every problem the solution comes after its registration and depiction, after its visualization, especially when it is space-dependent. So, we decided to make this map which in first level could help special people move, knowing exactly what to face or not and in a second approach will provoke authorities to try make things better.

In order to create an access map for people with disabilities, it is important to record and to indicate on a map the obstacles, a physically challenged person will find in his route, during his effort to move outdoors at the University Campus or to enter one of the buildings of the Aristotle University of Thessaloniki. These difficulties come up due to obstacles existing in the surroundings, or due to the bad construction of roads or pavements which can additionally, cause safety problems to them. The location of those obstructions and the identification of difficulty in accessibility encounter by each category of challenged people will be the data for designing paths

within the Campus, on which these people can move by putting the least possible effort. This is very crucial for a university campus, where a lot of people move every day, using different routes sometimes more than once a day, covering their needs of parking their cars, working, teaching, studying, eating and sometimes living inside it.

#### **4.1. Data collection and analysis**

The areas where there are obstacles hindering the transit of disabled people or areas showing problems in their construction are detected in the University campus according to the legislation mentioned before. The research was restricted in the outdoor area of the campus and in all the buildings' entrances.

##### *Categories of People with Disabilities*

The disabled people included in the research, were separated in four categories:

- People with disabilities, mainly with mobility problems
- People visually impaired
- Blind People
- Special People, who are facing difficulties in moving in particular places due to a specific reason (pregnant women, mothers with baby trolleys, elderly people, children or people carrying huge objects etc.)

Blind and visually impaired people use mainly their sensations and in combination with their cognitive abilities, they can orient themselves in a place and move in it accordingly. For them, mobility and orientation are two very important words.

##### *Categories of obstructions and accessibility problems*

Thinking of the different categories of disabled people, it is obvious that each of them has different needs in moving around independently, which are covered by the state's legislation. For this reason, it is necessary to characterize each of the obstacles according to the level of difficulty a person of each category may have to move in the University campus or to access a particular place such as a building.

The obstacles existing in the "mobility route" of people with disabilities can be temporary and movable or permanent. For an area with the temporary obstacles, it is easier a solution to be found in order to reinstitute its accessibility to all the people, whereas for the permanent obstructions, which are usually result of the bad construction of a place or a building, not designed

in compliance with the relative legislation, things are more difficult to be changed. In the University Campus, 59 temporary and permanent obstacles or accessibility problems are detected (*Figure 8*). The temporary obstacles recorded in this research were those having a more permanent character, since they are repeated continually in everyday life.



**Figure 8.** The University campus of Thessaloniki (red line) and the 59 "problematic" areas detected in it (yellow dots).

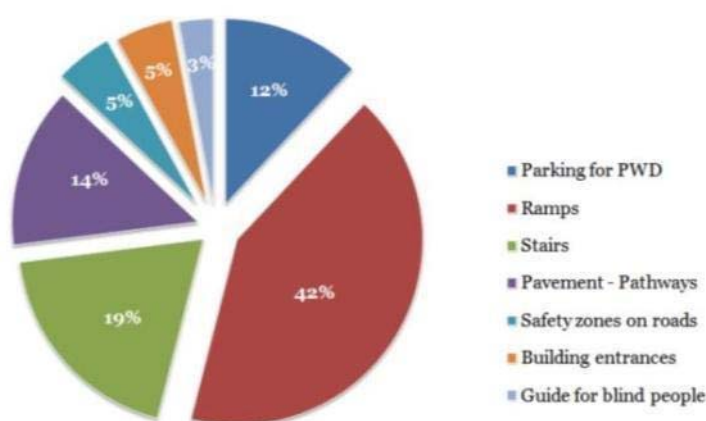
These obstructions were evaluated for each group of disabled people, in a scale 1 to 5, having as criterion the difficulty these people encounter in their attempt to access the relevant areas. These categories are:

- 1 – very easily accessible obstacles
- 2 – easily accessible obstacles
- 3 – obstacles, accessible with difficulty
- 4 – obstacles, accessible with much effort
- 5 – obstacles, with almost no accessibility for a category of disabled people.

#### **4.2. Results from fieldwork**

Analyzing the data collected in the University campus, the 59 problematic access points recorded in that area concern obstacles in the buildings' main

entrances such as stairs with no handrail or lift, heavy doors difficult to be opened without help or obstacles in front of the entrances. They are also referred to obstacles in the surrounding area such as ramps with construction problems, steep or narrow pathways and obstacles in the guide for blind and visually impaired people. The percentage of these different obstacles detected in the University campus is recorded on a diagram on *Figure 9*. It is also important to mention that there are no special chromatic signs on the buildings, which could help the visually impaired people to recognize the area, nor signs in Braille writing system and tactile maps to help blind people to move around easily, actions already included in the relevant legislation.



**Figure 9.** Diagram of the percentage of different type of obstacles in the University campus.

In some cases, measures were taken for the accessibility of disabled people. A guide for blind people is designed in Campus but it is only extended in a small area and also, parking areas are constructed exclusively for people with disabilities. However, there is problem also in these cases, since there are often cars parking on places for disabled people, or obstacles interrupting the guide for blind people, making difficult to them to use these facilities or to move around and access a place.

The difference and the complexity of the obstacles and the different degree of difficulty each group of disabled people mentioned above may have accessing a place, indicate the necessity of the existence of a map, where all this information will be combined together in order to depict the problematic areas for each group, offering them the opportunity to know the difficulties they may encounter to move around before they go there.



### 4.3. Map in paper printed form

The paper printed map created for this reason, both in Greek and in English language, depicts these “problematic” areas existed in the University using appropriate symbols, which give information about the nature of the obstacle, the kind of people’s disability influenced by it, as well as the degree of difficulty for these people to overcome this particular obstruction. In this way, through this map, anybody having a kind of disability or helping a disabled person can find the best way to access the desired place.

For the compilation of this map, the vector file of a map for the University Campus made some years ago<sup>1</sup> was used and updated from satellite images in order to show correctly the changes made recently in the campus, mainly due to the construction of the METRO passing over this area (*Figure 10*). The updated vector file consisted the background of the map, where all the appropriate symbols were also added in order to show the areas in the University campus, on which a person with a kind of disability have to pay attention or to avoid in order to go safely to his destination.



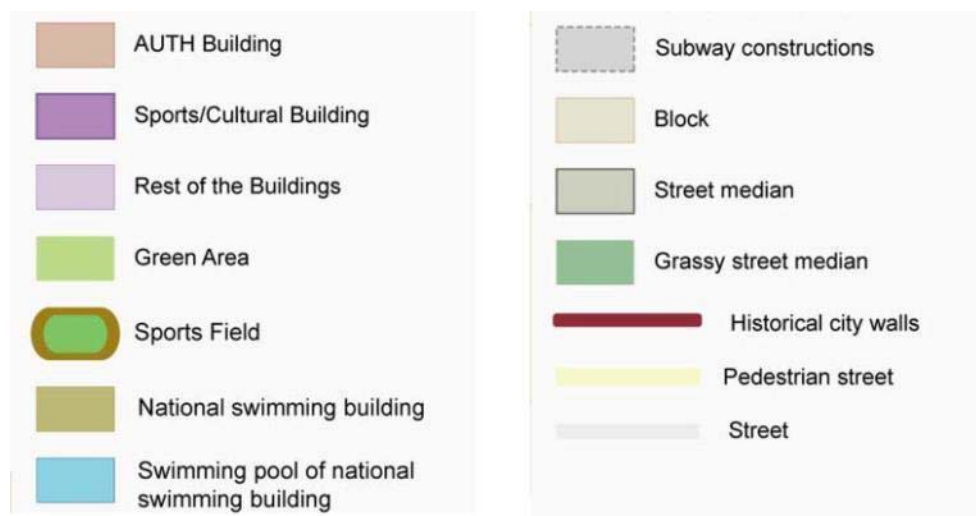
**Figure 10.** Updating an existed vector file to create the background of the map.

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<sup>1</sup>Aristotle University maps on four scales of geographic representation constructed by Prof. Evangelos Livieratos and Chrysoula Boutoura in Thessaloniki in 2006.



The selection of the most appropriate symbol to depict the obstacles on the map and on the same time to give information about the accessibility in their location to different people according to their form of disability was a challenging procedure. It should be a simple symbol easily recognizable by all and easily readable on the map. Moreover, it was important this thematic information to be more distinguishable than the other characteristics of the map. To combine all these prerequisites, fade colors are used for the background of the map (*Figure 11*) and strong colors for the symbols depicting the blocked areas.

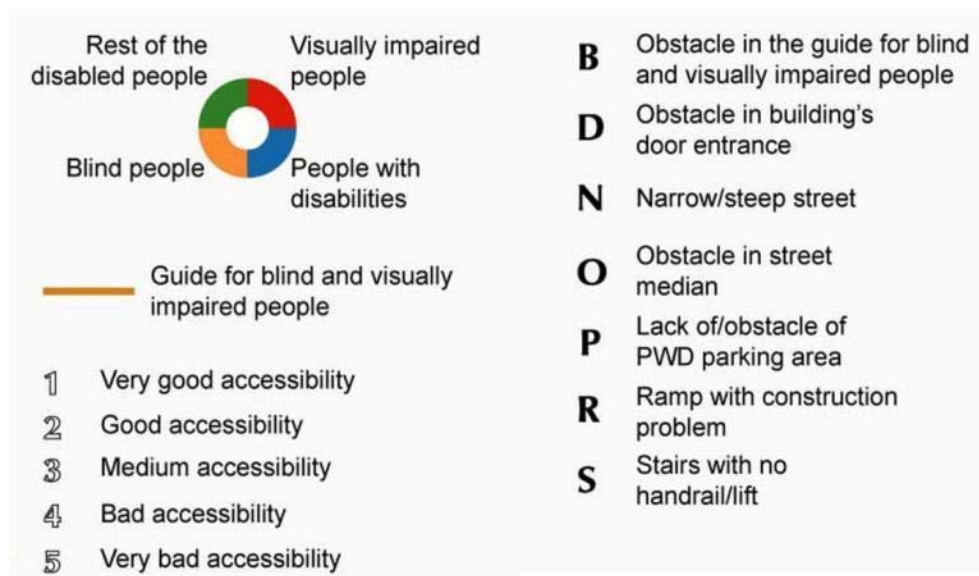


**Figure 11.**Symbolology used for background characteristics of the map.

On the selected symbol, three characteristics are depicted as it is shown in *Figure 12* the four categories of people with disabilities with different colors, the nature of the different obstacle with a character and the degree of difficulty each of the disabled people encounters to overcome the obstacle representing it with numbers inside the relevant colors. These synthetic symbols are explained analytically to the legend of the map presented in *Figure 13*. Each obstacle does not concern all the categories of disabled people. In this case the symbol includes only the colors of the involved categories.



**Figure 12.** The symbol shows that in its position, there are stairs without a hand-rail or a lift (S) and that this obstacle concerns all the categories of disabled people defined in this study, showing for each of them the degree of difficulty they will have to overcome.

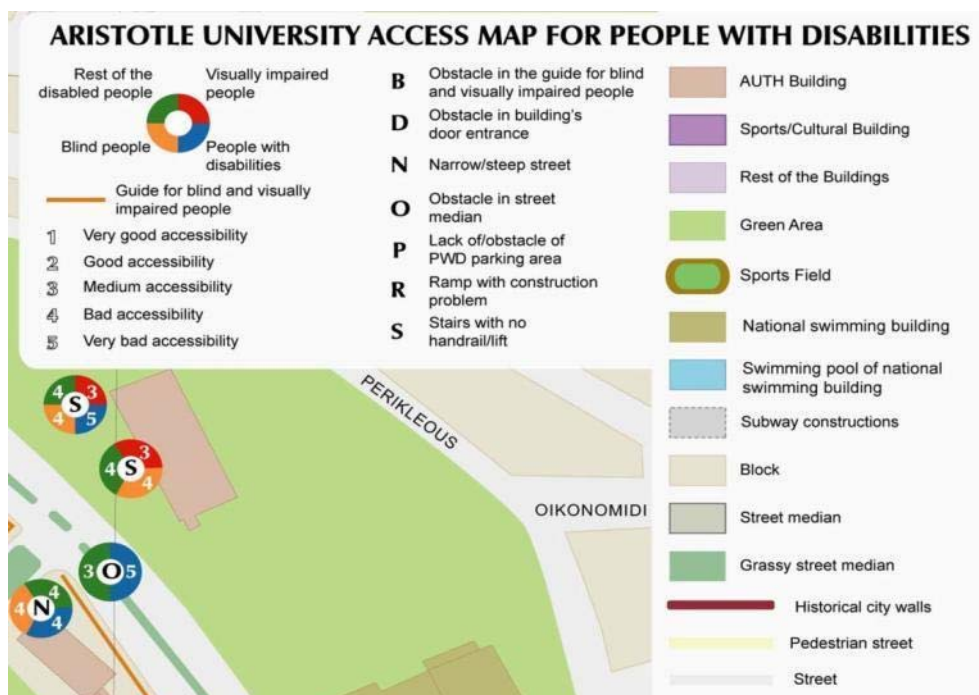


**Figure 13.** Analytical explanation of the synthetic symbol used for the depiction of the places difficult to be accessed by people with disabilities.

The map is constructed in scale 1:2000 and designed in Transverse Mercator projection applied in three zones for the Greek territory. The University campus is situated in the central zone with the prime meridian passing over the Observatory of Athens and having 0° in the projection and the Bessel 1841 as a reference ellipsoid. A detail of the map and its legend are presented in *Figures 14 and 15*.



**Figure 14.** Detail of the access map of the Aristotle University of Thessaloniki.



**Figure 15.** The legend of the access map of Aristotle University of Thessaloniki.

Through this map (*Figure 16*), the user has the opportunity to find out based on his personal disability which areas he has to avoid in order to move with safety around and to reach his destination with less problems. The map was constructed both in English and Greek language so as to be useful also to people of other nationalities, moving in the Aristotle University Campus.



**Figure 16.** Aristotle University Access Map for people with disabilities.

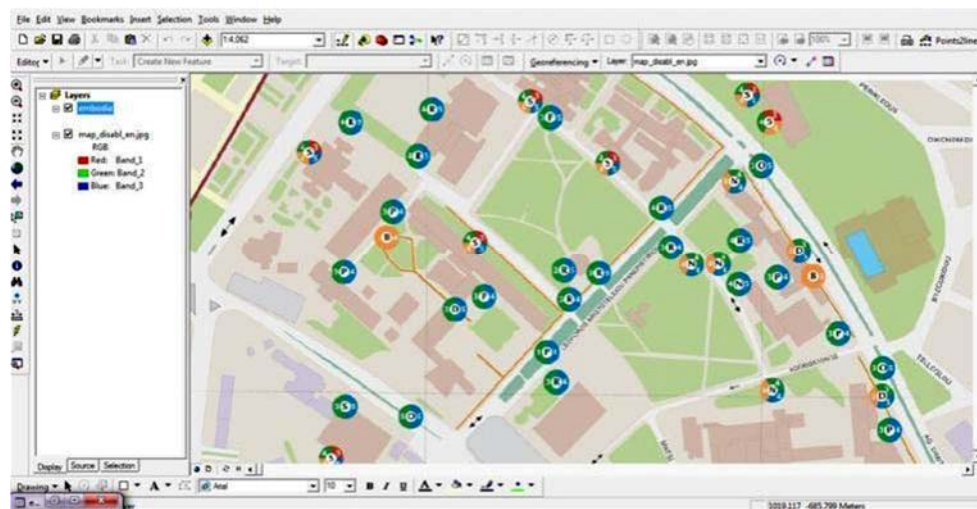
#### 4.4. Map in digital interactive form

More detailed and efficacious is the digital interactive counterpart of the map which gives information to the user about the exact obstacles he will



face in his route, their description and images of them. In this way, the user can also estimate by himself if a place is easily approachable or not and finally he can make his own plan for going there.

The interactive version of the map was constructed on GIS environment. The information described through the symbols-guides for the disabled people are recorded on a database which was connected with the spatial database of the symbols (*Figure 17, 18*).



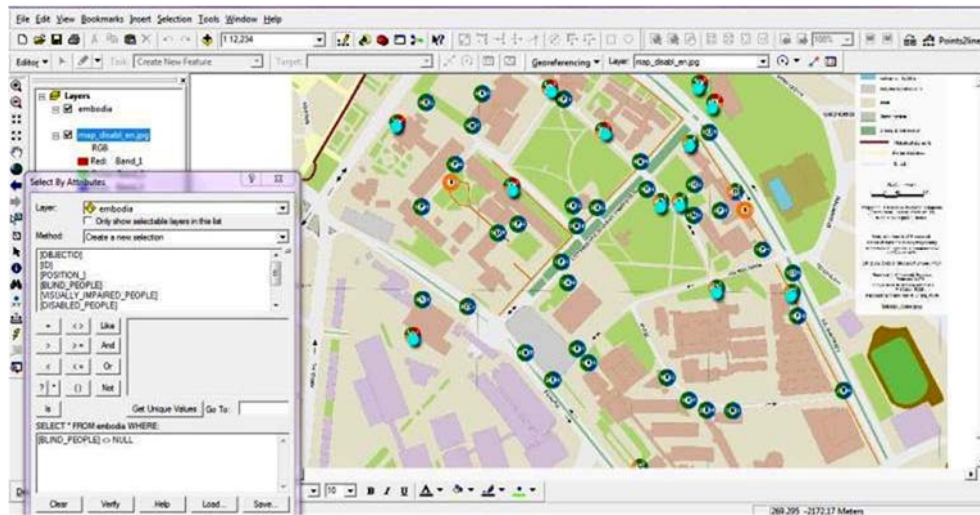
**Figure 17.** A part of the University campus showing the obstacles on the interactive map with the same symbology followed for the printed map.

OBJECTID	SHAPE	ID	POSITION	BLIND PEOPLE	VISUALLY IMPAIRED	DISABLED PEOPLE	BEST DISABLED PEOPLE	DESCRIPTION	IMAGE
43	Point	34	İmparçık Zeytinli	5	<null>	5	3	gözetimci 'kızamıkçık' marmar	E:\Marmar\kızamıkçık
44	Point	35	İmparçık Zeytinli	<null>	<null>	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
45	Point	36	İmparçık Zeytinli	4	<null>	4	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
46	Point	37	Teknikler	4	3	<null>	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
47	Point	38	Teknikler	4	3	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
48	Point	39	Teknikler	<null>	<null>	5	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
49	Point	40	Teknikler	<null>	<null>	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
50	Point	41	Kurumun önünde Zeytinli	4	3	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
51	Point	42	Bahçe	<null>	<null>	4	2	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
52	Point	43	Kurumun önünde Zeytinli	<null>	<null>	5	2	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
53	Point	44	Bahçe	<null>	<null>	5	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
54	Point	45	NOVE	4	3	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
55	Point	46	Osmanlı Zeytinli	<null>	<null>	4	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
56	Point	47	Bahçe	4	<null>	4	<null>	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
57	Point	50	İmparçık Zeytinli	<null>	<null>	4	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
58	Point	51	Teknikler Zeytinli	<null>	<null>	5	3	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı
59	Point	52	Teknikler Zeytinli	4	3	5	4	kurumun önünde park alanı	E:\Marmar\kurumun önünde park alanı

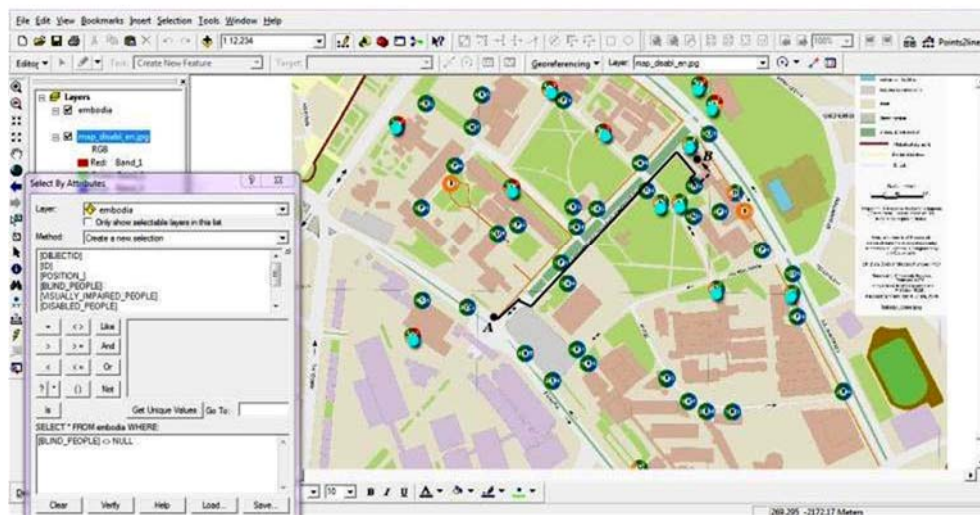
**Figure 18.** Part of the database where the information about obstacles is stored.



This database gives the opportunity to users, through relevant queries to find out more easily the places where the accessibility is not very easy (*Figure 19*) and also to find out the possible ways to go from one place to the other and to move around in the University campus (*Figure 20*).

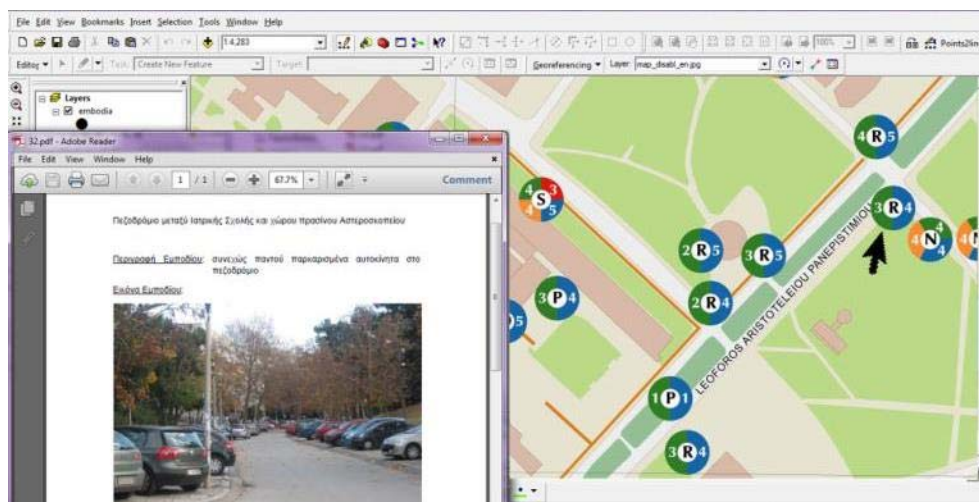


**Figure 19.** Detection of the obstacles which are difficult to be approached by blind people (Degree of difficulty: 4 and 5).



**Figure 20.** Proposed route from place A to place B for a blind person. This person has to pay attention if he wants to enter the building from the entrance close to the road, due to construction problems on the pavement in front of the entrance of the building. The most safe and short route is the one proposed by the software.

Through the software, it is possible for somebody to find more information about the type of the obstacle, to see the relevant photos and to decide on his own about the best way to move around in order to approach easier to its destination (*Figure 21*).



**Figure 21.** More information and photos of the problem existed in a specific area can be provided through the software.

The construction of the interactive map is still in progress in order to include as much information is possible to be found for the problematic areas already recorded in the database, but also to record new areas in the University campus with constructional problems which can cause difficulties to disabled people.

This spatial database can be useful, apart from people with disabilities, to the relevant services showing to them all the accessibility problems existing in the University campus and enable them to receive measures to reinstitute the accessibility for all the people in these areas.

## 5. Conclusion

People with Disabilities are considered to be a sensitive group of people, demanding specific requirements on their mobility. For this reason, the construction and modulation of public areas should fulfill the requirements which allow these people to have access to any public place. This is more important for a University campus, since education is an inalienable right

for all the people and a key factor playing a catalytic role on everyone's life and its evolution.

Since this is not always easy to be accomplished due to different constructional problems, it is necessary for these people to be informed about the situation they have to face moving around in different areas of the University campus. The first step in this direction is to record all the problems existed in the surrounding area and to depict them on maps. These maps, like those created in this study, can be really useful to many people, since they describe the accessibility problems of an area, helping on one hand the disabled people to find the best way to their destinations but also emphasizing that measures should be taken by the responsible service, in order to make an area like the University campus accessible to all people. Our next goals, based on previous experience, are to transform this map into a tactile one so visually impaired people can use it and decide to move in a proper way in the University campus of Aristotle University of Thessaloniki as well as to do same type of projects for other University campuses in Greece.

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